REMARKS/ARGUMENTS

Applicant responds herein to the Office Action dated May 6, 2004. A Petition for Extension of Time (three months) and the fee therefor are also enclosed.

Claims 1-10 are pending in the application.

This section of the Office Action comprising paragraph 2 which appears under the caption "***Response to Arguments***", at pages 2-19 of the instant Office Action, will be addressed further on. Preliminarily, the applicant addresses the rejection of claims 1-10 under the first paragraph of the 35 U.S.C. §112, as set forth in paragraph 4 of the Office Action and the rejection of claims 1-10 under 35 U.S.C. §101, pursuant to paragraph 5 of the Office Action (as set forth at pages 22-23).

Independent claim 1, as amended, can be viewed as consisting of a first part that contains the preamble and the six paragraphs which follow, and a second distinct part which consists of the last paragraph of the claim, which reads:

> wherein by means of unit charges (1.602×10^{-19}C) coming in and out of said nano-particles and confined by a barrier, and generating irregular AC potential by heat on respective said nano-particles, ambient temperature of said apparatus in a thermal equilibrium state is converted by itself so that said apparatus continuously produces said DC electromotive force.

The first part of claim 1 clearly defines a semiconductor structure which has never been alleged throughout the prosecution not to be novel or to be obvious in light of the prior art. With that structure, the applicant has described and persisted one obtains a DC electromotive force which is produced by the defined "nano particles".

The second part of claim 1 explains what applicant regards as or at least believes to be the physical principle of operation of the previously defined structure, i.e., that it generates the DC electromotive force via the expedient of converting ambient temperature to the DC electromotive force.

With the foregoing observation in mind, the applicant respectfully traverses and requests reconsideration of the contention of paragraph 5 of the Office Action that the claims are rejectable under 35 U.S.C. §101 on the ground that they lack utility. This makes no sense at all.

A device that produces a voltage, regardless of the dispute of how this occurs, by definition has a utilitarian function. The ability to produce an electromotive force cannot be a basis, as set forth in paragraph 5 of the Office Action, for the rejection under 35 U.S.C. §112, first paragraph, on the assertion that the claimed invention is not supported by either a substantial asserted utility or a well established utility. Clearly, the invention has a utility. It produces an electromotive force and that is more than sufficient. Therefore, the rejection in paragraph 5 of the Office Action should be reconsidered and withdrawn.

Turning to paragraph 4 of the Office Action and the rejection of claims 1-10 under the first paragraph of 35 U.S.C. §112, it is noted preliminarily, that the basis of this rejection is on the ground that the specification allegedly fails "to comply with the enablement requirement". The "enablement" requirement of 35 U.S.C. §112 refers to the language of §112 which sets forth that the specification shall contain a written description that includes "the manner and process of making and using it [the invention], in such full, clear, concise and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same...". Respectfully, it is illogical to raise the enablement requirement with respect to a claim to an apparatus that specifically sets forth the physical structure thereof and which describes in great detail in the specification how to assemble its physical components to produce the overall and final device.

A dispute between the applicant and the Patent Office as to the underlying physical principles that cause the apparatus to operate, do not concern enablement. Indeed, it is well established in the Patent Law that an inventor does not have to set forth, does not necessarily have to understand, and indeed, does not have to disclose "how" or "why" a particular structure produces a particular result.

Based on the foregoing remarks, the applicant traverses and requests reconsideration and withdrawal of both the §112 rejection that is set forth in paragraphs 4 and 5 of the Office Action.

Addressing now the section of the Office Action under the aforementioned caption "***Response to Arguments***", it remains so that the applicant and the Examiner are locked in a disagreement as to whether the claimed structure of the invention, which undeniably produces the continuous DC electromotive force, is attributable to the conversion of ambient temperature

while the apparatus maintain a thermal equilibrium into the DC electromotive force (as alleged and asserted by the applicant) or whether the resulting DC electromotive force is attributable to another cause, as for example, a chemical or other unexplained or not understood reaction (as alleged by the Examiner).

However, the foregoing impasse simply is not and should not be deemed to be an impediment in the path to allowance of the instant claims. The Office Action states that the basis of the rejection is not because the Examiner disagrees with the notion that there may be exceptions to the second law of thermodynamics. But in fact, that is the sole and only basis of the rejection, which the applicant believes is inappropriate under the circumstances.

Parenthetically, by the logic of the Office Action, allowing a claim such as claim 1 herein would have no real consequences because no device would ever infringe such claim because it is impossible to construct the device of claim 1.

On the substance of the remarks in the Office Action vis-à-vis the applicant's claims, there are reproduced below comments which the applicant has authored and which are included in the instant Response with the further proviso that these remarks will soon be submitted to the Patent Office in a Supplemental Communication, in the form of the applicant's further Declaration under 37 C.F.R. §1.132. These remarks are as follows:

1. Introduction

The Examiner's reasons for rejection have been carefully considered.

However, it seems that the Examiner and the applicant hold different views in many aspects. In the applicant's view, this application discloses a simple construction and the effects resulting therefrom, and also the subject matter of the invention is based on fundamental principles. On the other hand, reading the Examiner's statements in the outstanding Office Action, it is thought that the Examiner construes the invention of this application as being sophisticated and complicated. Fortunately, however, the applicant thinks that it has progressively approached a more essential and substantial issue of this application, compared with the previous communications.

For reference, the applicant notes the current status of Korean patent application corresponding to the present invention. The Korean corresponding patent application has been

filed on February 11, 2000 and issued on August 11, 2004 as Korean Patent Registration No. 10-04445317. During the prosecution of the Korean patent application, the applicant had submitted to the Korean Patent Office a pilot product, which embodies the spirits of this invention, and demonstrated its patentability and practicality of the subject matter of this application.

Up until recently, the applicant has conducted the experiments related to the invention independently. The applicant has kept introducing and explaining the applicant's invention to the relevant academic world and college professors in the Republic of Korea. Consequently, they have come to recognize that the applicant's invention needs a formal confirmation as to whether it will be practically operated in the manner to have been intended by the inventor. Accordingly, Korea Institute of Science and Technology (KIST) and Seoul National University have promised to provide support for the confirmation experiments and tests. In particular, Yonsei University, from which the applicant graduated, now provides a positive cooperation, including a separate experimental space and a dedicated professor. The applicant has been preparing for the confirmation experiments for around four months, and the Korean relevant academic world will join the experiment beginning at the end of October.

The applicant intended to submit a response to the outstanding Office Action, together with some results from the current experiments, but it has taken much more time to prepare for the experiment than expected. Hopefully, the experimental evidence would be submitted later, and here the applicant's opinions will be presented with respect to several issues, on which the applicant holds a different view from the Examiner.

2. With respect to the Examiner's statement "An aggregate consisting of materials having different chemical potentials does not establish a thermal equilibrium system".

This view of the Examiner, which is mentioned in most items of the reasons for rejection, nullifies the applicant's efforts and decisive evidences. Therefore, the applicant will present clear opinions on this matter as follows.

Scientific concepts for expressing a state of materials or systems, for example, "thermal equilibrium," "isolated," "self-contained," "ideal," or the like, are used for establishing an assumption or a premise for the sake of understanding, admitting that there is a discrepancy

between the assumption or premise and the real phenomena. There is no reality descrilbed as a perfect thermal equilibrium. In order for two objects having different temperatures to be in contact and reach a perfect thermal equilibrium, an infinite period of time is required. In addition, a system constituting a single material cannot be established in real life, and instead, always a contact with other materials should be associated in the physical world.

However, there exists a concept of thermal equilibrium, through which various phenomena of nature are interpreted and explained. For example, in the case where copper having a relatively high value of electrochemical potential is contacted with zinc, an external circuit contacted to each individual does not exhibit an electromotive force. What is expected from the known knowledge is an inter-diffusion of atoms between the copper and the zinc. Even if a heating-up or cooling phenomenon occurs due to the inter-diffusion of atoms, it can be treated as a thermal-equilibrium system as long as a certain issue or question under consideration is able to ignore the temperature variation caused by such minute reaction rate. In case where an iron tank is filled with a high-pressure oxygen along with a tiny amount of moisture and has been placed in a constant temperature room for a long time, it could be treated as a thermal-equilibrium system. That is, even if a local heat is continually generated due to the reaction between the iron and oxygen, such a slight reaction rate could be ignored. The reason why these fundamental and basic issues are discussed here resides in the Examiner's statement, "an aggregate consisting of materials having different chemical potentials is no longer a thermal equilibrium system." If it were true, there would not exist a thermal equilibrium system anywhere in the universe, nor even the very concept called "thermal equilibrium."

Furthermore, the concept of thermal equilibrium has been present since the discipline called "thermodynamics" was born. It has the same meaning all the time. As may be accepted by the Examiner, at the time when the concept of thermal equilibrium was established, the science of physics and chemistry was not so much advanced, compared to the present modern days. A system, which in the past could have been concluded to be in a state of thermal equilibrium, has been found out to have, in reality, numerous non-equilibrium factors. In other words, the concept of thermal equilibrium had been first established, and thereafter a non-equilibrium factor was introduced. In order for a system to present an equilibrium state, it

is therefore inevitably assumed or propositioned that the system does not contain any non-equilibrium factor, or that, if it exists, it can be ignored.

Here, the applicant thinks that some discussion on the non-equilibrium factor is needed. The Examiner has alleged that an aggregate consisting of materials having different chemical potentials is not a thermal equilibrium system. With all due respect, this is incorrect. To be called a thermal-equilibrium system, all the portions thereof must remain in the same thermal state, i.e., in the same temperature, and no other conditions are required. In order to reach such equilibrium state, a local exothermic or endothermic phenomenon must not take place. As understood from the known scientific knowledge, an exothermic or endothermic phenomenon is caused by a motion, an electric current, a chemical reaction, a phase transformation, or the like. In case where materials having different chemical potentials are maintained in contact with each other without any chemical reaction, or where these contacted materials have experienced a chemical reaction when contacted and thereafter are held without any more substantial chemical reaction due to the shielding effect of the product from the previous chemical reaction, it can be considered as being in a state of thermal equilibrium. It is because no exothermic or endothermic reaction has been occurred. If a condenser with no current leakage by means of a good insulation is held inside a thermal equilibrium system, it is also able to establish a thermal equilibrium system. In other words, it is the case because its electrical or chemical potentials are maintained constant without being consumed, for example, due to an exothermic reaction or the like. It is identical to a state where an object having a potential energy remains in a position and consequently in an equilibrium state. If the object moves, the thermal equilibrium will be broken, for example, by a frictional heat and the like.

For example, when two materials, which are different in their chemical potentials, are contacted with each other, an electromotive force is not always created. Only if a mobile ion exists between the two materials, an electromotive force can be generated. Furthermore, when the mobility of ions is greater than the electrical conductivity of electrons, it is exhibited in the external circuit as an electromotive force. (See Battery Handbook, pp 3-159, 1975, published by 日本電氣書院 *(of which English name can be translated into 'Japan Electric-concerned*

Bookstore' but the exact English name is not available) It is because the negative ions travel in opposite direction to the electrons while the electromotive force is being generated.

As with the construction of the applicant's invention, if the gap between contacted materials is formed such that the tunnel effect can take place, it requires an adequate mobility of ions to an extent that is able to overwhelm that of electrons. In the applicant's invention, the material placed between the two materials of test specimen is a chemically stable material such as SiO2, SnO2, GeO2 (used for an insulation material of MOS element, a transparent electrical conductive membrane, a material for dielectric elements). These materials are a far cry from what is called a solid electrolyte, in particular at room temperature. ***If the ions move extremely slowly, the current value can be ignored. Even if the electromotive force (voltage-current) measured from the contacting face of two materials, which have a big difference in their chemical potentials, has a considerable value of voltage, its output energy can be ignored as a tiny sum because of its very small value of electric current.*** *Also, the heat of the dielectric materials generated by the small electromotive force is not significant. Therefore, the applicant has concluded as a thermal equilibrium system the measuring system shown in the reference figure 3, which has been submitted on January 14, 2002 (hereinafter, referred to as the "measuring system"). In the measuring system, the current flowing the dielectric material is very small to the extent that an impedance meter (10mega-ohm) does not respond thereto. This has been explained in the response submitted as of January 14, 2004. Considering these matters deeply and seriously, the applicant has concluded the measuring conditions as a thermal equilibrium system and also confirmed it through an experiment.*

It seems that, only from a vague possibility that an electrochemical electromotive force might be involved here, the Examiner has alleged that the measuring system is not a thermal equilibrium system, and moreover has requested an error analysis data. It seems to the applicant that the Examiner incorrectly understands the scientific principles related to the electrochemistry and the electrical circuits. For example, the Examiner considers only the voltage, excluding the electric current. It should be remembered that the output energy is determined from both the voltage and the current, i.e., from the voltage times the current.

3. *With respect to the examination of this application applying the existing thermodynamic principles and known knowledge.*

The applicant's invention has not been derived from the existing scientific theories and principles, but discovered from an incidental experiment. The applicant had many experiences of confusion when having tried to interpret the applicant's invention through the known thermodynamic theories. It is thought to the applicant that the Examiner may experience the same situation as the applicant's.

The conventional heat engine is a device where a quantity of heat Q is transferred from a state of higher temperature T1 to a state of lower temperature T2, during which a portion of the heat quantity Q is converted into mechanical energy. Here, the same numerical value Q is required to be distinguished from temperature T1 to temperature T2 and expressed as Q/T1 and Q/T2 respectively, which has been conceptually called the entropy of the system. With the conventional thermodynamics, the conversion of heat into mechanical energy is measured in terms of the magnitude of change in the entropy. In the natural system, the state Q/T1 may be changed into the state Q/T2, but never in the opposite direction. This phenomenon has been empirically recognized and generalized as the second law of thermodynamics.

The applicant invention is directed to a conversion device which converts heat into electrical energy, in which heat from a heat source of a single temperature can be converted into electrical energy. It is therefore unreasonable to attempt to appreciate the present invention through the conventional thermodynamic principles, which also involves the conventional concept of entropy. Nonetheless, the Examiner has examined the invention of this application using the existing thermodynamic knowledge only, and also asked the applicant to persuade him within the range of the existing rules and principles of the conventional thermodynamics. The applicant questions the justification therefor.

In the conventional heat engine, the conversion of heat into mechanical energy is measured in terms of its entropy change, but in the present invention, the conversion of heat into electrical energy is measured only in terms of a change in the quantity of heat.

Up until now, the Examiner has held on to the conventional interpretation using the entropy change. An example thereof is the fact that the Examiner has consistently requested a

plot of entropy expressed as a function of time. This is clear evidence that the Examiner fails to understand the subject matter of the present invention.

The applicant respects the Examiner's sincere attitude and thoroughgoing examination toward this application, but it seems that the Examiner fails to properly understand the subject matter and associated technology of the applicant's invention. In spite of the fact that a lot of time has been spent in examining this application, things have not been changed, rather it seems to have become more complicated. The applicant does not want it, and believes the Examiner also does not.

Possibility for such a device has been known for around 120 years as Maxwell's Demon (See Maxwell's Demon; Physics World, March 1999, p.21), but with the existing thermodynamics including its second law they could not have even predicted practicability of this technology. Therefore, it is unreasonable that the present invention is considered under the existing thermodynamic theory.

In the description of this application, applicant has declared that the present invention contradicts the second law of thermodynamics, i.e., to the effect that the second law of thermodynamics cannot interpret the subject matter of the invention. In order for this application to be fairly examined, therefore, the applicant thinks that the second law itself, relevant principle, and the like must not be used for the ground for rejection of this application. In other words, the Examiner must stand neutral in examining this application, not in the position of advocating the second law of thermodynamics, which may not be impartial in view of the applicant's declaration as described above.

The empirical phenomenon, pursuant to which electrical energy is output from the construction according to the present invention, has already been disclosed. The Examiner and applicant have agreed that energy can be generated from a non-equilibrium factor only. This non-equilibrium factor only has to be found out using the modern scientific knowledge. The applicant has made many attempts to find the non-equilibrium factor through the conventional thermodynamic theories and laws, but failed every time. Thus, out of the area of thermodynamics, what the applicant has found out is that 'the heat of an object can be converted into a rectified current from the rectifying barrier of a semiconductor via the thermal motion

(vibration) of electrons'. The justification thereof has been explained using the simultaneity theory, the condenser equations, the nano particle, or the like.

In the previous Office Action dated July 14, 2003, the Examiner had stated that the differences in temperature and chemical potential between two materials may generate a voltage, and thus this application cannot be allowed. In the outstanding Office Action dated May 6, 2004, the Examiner has stressed the latter, i.e., the difference in chemical potential. The grounds therefore reside in that; the applicant maintains that the present invention contradicts the second law of thermodynamics, whereas the Examiner asserts that the invention must not contradict the second law of thermodynamics. On this matter, the Examiner fails to stand neutral. This is, the Examiner has relied directly on the second law of thermodynamics. The Examiner has mentioned a certain mere possibility, to the effect that the electromotive force in this invention might be caused by the difference in chemical potential between two contacted materials. However, the applicant thinks that it is not fair. The applicant respectfully submits that, to be fair to both the Examiner and the applicant, the Examiner, in order not to accept the applicant's arguments, should present a reasonable degree of explanation and reference materials, comparable to those submitted and presented by the applicant.

Also, with respect to the measuring system presented by the applicant, the Examiner maintains that it has a non-equilibrium factor of chemical potential difference, but the applicant asserts that it has no non-equilibrium factor. The Examiner requests the applicant to submit an evidence material as to how there is no non-equilibrium factor. There is no equilibrium factor, and accordingly there is no relevant data and materials to be found. How can it be found out and presented? Now, the applicant thinks that the burden of proof belongs to the Examiner, who keeps insisting on the presence of a non-equilibrium factor.

Since the measuring conditions of the measuring system have been established as a thermal equilibrium system, the applicant believes that the data does not have any non-equilibrium factor and the data is believable, with only error from the measuring instrument. However, the Examiner asserts that the measuring condition is not a thermal equilibrium system, with a reason that an aggregate consisting of materials having different chemical potentials cannot establish a thermal equilibrium system.

In view of the forgoing discussion, it is believed that there may come out a solution as to whether the measuring system can be treated as a thermal equilibrium system. The applicant wishes that the Examiner would not block the birth of a new technology by overly relying on the authority of the second law of thermodynamics.

4. With respect to the ground for 0.1°C

The applicant has a firm belief that the measuring condition of the measuring system is a thermal equilibrium system.

Here, the accuracy of the thermal equilibrium is limited to within the error range of the measuring instrument. In addition, the error range of the measuring instrument is 0.1mV (0.05%) in the measuring range of 200mV.

The semiconductor material used in the present experiment has a carrier concentration of about 5×1018/cm3, in which a thermal electromotive force of around 0.3mV is exhibited with respect to a temperature difference of 1°C. That is, it corresponds to 0.1mV for 0.33°C. Therefore, the measuring instrument cannot detect an electromotive force caused by a temperature difference less than 0.33°C. The thermal equilibrium condition is set up as below 0.1°C, which is much lower than the error range of the measuring instrument and thus gives a good enough allowance.

The statement "general measurement value=1mV" is based on the experience from numerous experiments (over 1,000 times) that, when 1mV is measured in the measuring instrument, the effect value of the present device is always included. Therefore, it means an average upper limit value of the error. Regarding this value as the upper limit of the error, the measured value is reliable.

5. With respect to the Examiner's opinion that the Examiner needs only the materials requested, but has nothing to do with "Understanding. "

It is believed that, without a reasonable understanding, one could not request any appropriate reference materials and also apply them properly, even if he or she has the right and appropriate one.

Here, a further explanation on the magnet lead switch may be needed. The intensity of magnetic field for the magnet switch to come to "on" is constant. For example, a magnet switch,

which comes to "on" at the magnetic field of 500 gauss, does not turn to "on" at 499 gauss. When "off" is switched to "on," the change in the magnetic field is 1 gauss (500-499=1gauss). The switch can be operated by a magnetic field change less than 1 gauss. It could not be measured how the change of 1 gauss in magnetic field contributes to the value of output energy. However, it is clear that the voltage induced by the magnetic field exists momentarily and the value of the induced voltage can be made to be within the error range of the measuring instrument. The value can be minimized when the core is the same plane as the circuit. Considering being a metallic material, the momentary state of non-equilibrium caused by the impact heat-up of the switch contact point will reach a thermal equilibrium state in a few minutes.

Afterwards, the measuring system has a constant value of entropy, which is less than in the thermal equilibrium state with the magnet switch being "Off." It is believed because of the conversion of heat into electrical energy due to the effect of the present invention and the continuous exothermic process due to the consumption of the converted electrical energy. The Examiner pointed out that, after the magnet switch turns on, the system is no longer at the state of a thermal equilibrium because of the fact that the magnet switch is turned on. This is not true. The fact that the non-equilibrium state occurred by the switch operation is maintained contradicts the second law of thermodynamics in terms of a macroscopic system. Correctly speaking, a portion of non-equilibrium, which is caused by the switch operation, will be vanished to proceed to a thermal equilibrium sate, and a non-equilibrium state can be maintained by the effects of the present invention. It is an erroneous understanding that the generation of electric current is caused by the 'on' operation of the switch. The generation of electricity results from the effects of the applicant's invention. Any external non-equilibrium elements introduced from the outside of the measuring system will disappear over time, and afterwards the non-equilibrium factor in the output energy is within the error range of the measuring device.

In addition, it is necessary to clarify that Peltier heat is associated with the effects of the construction according to the present invention. Therefore, further details thereon will not be repeated.

It is of great importance that a thermal equilibrium system is defined by a state of maximum entropy with respect to the quantity of heat reserved in the system. In a thermal equilibrium system, if a slight temperature variation or a tiny electric current occurs inside the system, the system can be decided to have moved toward a more ordered state, regardless of the accurate value of the temperature variation or the electric current. That is, the system has moved in such a direction that its entropy decreases. This phenomenon is an important tool for deciding that the system has proceeded toward a direction not conforming to the second law of thermodynamics. If the Examiner still asserts that, when the electromotive force is weak, the temperature variation of 0.33°C cannot be made so that it still remains in a thermal equilibrium state, the applicant wishes the Examiner to know the fact that, if the dielectric member is made extremely small, a high-temperature of heat can be easily obtained.

In view of the foregoing remarks, the Examiner is respectfully requested to reconsider the application, allow the claims as amended and pass this case to issue.

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as First Class Mail in an envelope addressed to: Mail Stop Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on November 8, 2004

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